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BIOLOGICAL
EVALUATION R4-80-3

Effects of Defoliations by Western Spruce Budworm

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EFFECTS OF DEFOLIATIONS BY WESTERN SPRUCE BUDWORM

SALMON, TARGHEE, AND BRIDGER-TETON NATIONAL FORESTS

1979

INTRODUCTION

The western spruce budworm (Choristoneura occidentalis Freeman) is a major defoliator of Douglas-fir (Pseudotsuga menziesii) and true fir (Abies spp.) in the western United States. Outbreaks of this insect can cause severe defoliation with subsequent tree mortality, top kill, and radial growth loss. Reliable damage information is needed to help forest managers determine the most effective, economical and environmentally acceptable approaches to managing the western spruce budworm.

During the summer of 1979, a damage assessment was conducted to collect information on the effect of defoliation by western spruce budworm to Douglas-fir timber types. Defoliated commercial forest stands on the Salmon, Targhee and Bridger-Teton National Forests were sampled. Data were collected for integration into the stand prognosis model and used to support other model development by the CANUSA Spruce Budworms Program.

The assessment survey was conducted by personnel from the Boise Field Office, Forest Insect and Disease Management and the Boise National Forest. Assistance was provided by personnel on the Salmon, Targhee, and Bridger-Teton National Forests, as well as FI&DM in Region 1 and FI&DR at the Pacific Southwest Forest and Range Experiment Station.

TECHNICAL INFORMATION

Insect: Western spruce budworm, Choristoneura occidentalis (Free.)

Host Trees: Douglas-fir, Pseudotsuga menziesii (Mirb)
Subalpine fir, Abies lasiocarpa (Hook) Nutt
Engelmann spruce, Picea engelmanni Parry

METHODS

Stands were selected by the individual forest timber staffs using criteria provided by FI&DM. Stands selected had to be in, or in close proximity to, areas of current budworm defoliation, homogenous as to size class and species composition; between fifty to one hundred acres in size. Stands were located on aerial photography or Ortho-Quad maps provided by the Forests. Field crews sampled stands which represented various levels of defoliation. These provided a better understanding of the effects of defoliation by the spruce budworm. In all, seven stands were sampled on the Targhee National Forest, five on the Bridger-Teton National Forest, and three on the Salmon National Forest.

Data were collected using guidelines provided by the CANUSA Spruce Budworm Program and later reformatted to fit the "INDIDS" computer program developed by FI&DM, Region 1. A special optical scan form was developed to aid in collection of the diversified data. This form was read and data

transferred to computer cards at the University of Idaho, then placed on file at the Fort Collins Computer Center in Colorado.

Two, 2-person crews were utilized to collect field data from late July to late August according to survey techniques provided by the CANUSA Spruce Budworm Program - West Impact and Assessment Working Group.

Plots were established at five chain intervals along an azimuth determined from photos or maps. The number of plots was determined using a ratio of one plot for every five acres of stand area. An effort was made to have a minimum of ten plots to provide an adequate number of samples. However, stand size was limited to no more than one hundred acres to prevent spending excessive time sampling any one stand.

At each plot center a variable (BAF 40) and a fixed (1/300th acre) plot were established. Variable plots provided data on tree species, dbh, height, and effect of defoliation by western spruce budworm to trees greater than or equal to 5" dbh which will be referred to as timber. Fixed plots provided data on tree species, defoliation and its effects on trees less than 5" dbh, which will be referred to as regeneration. Each tree was marked to allow follow-up checks of defoliation and associated injury as a result of budworm defoliation during the course of the outbreak.

Defoliation by western spruce budworm was determined using several different methods as prescribed by CANUSA-West instructions. First, current defoliation was estimated as a direct percentage at mid-crown and recorded to the nearest ten percent for all host trees on the plot. As an additional check, current defoliation was measured at mid-crown on the first two host trees over three inches dbh and less than 60 feet tall on each plot. This estimate was made using binoculars and rating 100 apical buds (50 from either side of a tree) on a scale of zero to five. (Table below).

Defoliation/Bud	Code
0	0
1-26%	1
26%-50%	2
51%-75%	3
76%-99%	4
100%	5

Each bud was assigned a defoliation value and the total value was recorded. Total values could vary from "0" for an undefoliated tree to "500" for one showing complete defoliation of current growth. Due to the time required for this procedure, after twenty trees in a stand were measured, only one tree per plot would be sampled.

Past defoliation was estimated at three crown levels: upper, middle, and lower. These levels were assigned values as follows:

PAST DEFOLIATION

Description	Code
No past defoliation visible, crowns appear to have a full complement of old needles. Current defoliation may be present.	1
Past defoliation visible, crown thin near branch tips. Old needle complement 0-25 percent of normal.	2
Past defoliation conspicuous, crown very thin. Old needle retention poor, 26-75 percent of normal.	3
Past defoliation very conspicous, crowns thin. Branch tips with less than 76 percent of normal needle complement. Branch tip die-back and top kill probably present.	4

Top kill was recorded as the ratio of dead top compared to total tree height and rounded to the nearest ten percent. If top kill occurred in a tree measured for height, a direct measurement was taken with a Relaskop and recorded to the nearest foot.

A radial growth measurement was taken for all trees which had a recorded height. On each, an increment core was extracted and the last ten years' growth measured to the nearest 100th inch. Using tree height, radial growth, and habitat type, projected heights could be calculated for sample trees. In trees with top kill, this height growth will not occur and volume reduction can be calculated by subtracting the actual from estimated tree volume.

In prior studies, stands have been assigned to analysis units which feature composites of numerical values depicting defoliation intensity over time. Five analysis units have been arbitrarily chosen to rank defoliation over the infestation period. During the annual aerial sketch mapping survey of the Intermountain Region, defoliation is rated light (1); moderate (2); heavy (3). By assigning a numerical value, affected areas of forests are rated for defoliation intensity. To display how areas have been affected over time, numerical values are added together. For example, a stand lightly defoliated 2 years but heavily defoliated 2 additional years would have a defoliation value of "8" and fall in Analysis Unit 3 with moderate damage (3x2) + (1x2)= 8. Since several of these areas were relatively new, defoliation values are somewhat low, and most stands fell into the lower analysis units at this time. Units were assigned using the following table.

Analysis Unit	Defoliation Value	Defoliation Intensity Over Time
1	0	None
2	1-6	Light
3	7-12	Moderate
4	13-21	Heavy
5	22+	Severe

RESULTS

The "INDIDS" Program for analysis of insect and disease activity provides breakdowns of stands according to tree species, size class and degree of defoliation, top kill and mortality. Information is given in trees, board feet, and cubic feet per acre as well as basal area and growth reduction for those stands which show top kill. To better understand the overall effects, groups of stands are combined and averaged to depict areas or stands with similar characteristics. To reduce the amount of data referenced in this report, trees/acre (T/A) will be used to display effect to all size classes including regeneration, and cubic feet/acre (CF/A) will be used to show volumes of timber affected by mortality and top kill.

For an overall view of the effect of defoliation by spruce budworm, a comparison was made using two variables. In Group I, stands that had a basal area under 110 and a defoliation value of 12 or less were combined and averaged. In Group II, all stands with a basal area in excess of 110 were combined with those stands having a basal area under 110 but a defoliation value greater than 12. Defoliation values are explained in the methods section under Analysis Units.

In Group I, stands with less than 110 B.A. and light-to-moderate defoliation, less than 1% of the Douglas-fir showed top kill and no mortality was detected. Defoliation observed on these stands ranged from none to heavy with trees divided evenly among the defoliation levels (Tables 1 and 2).

Group II, stands with a basal area over 110 or a defoliation value greater than 12, experienced the most top kill and mortality. Less than 3 percent of the Douglas-fir in this category had no observed defoliation and over 60 percent of the trees had moderate to heavy defoliation. Top kill occurred in 4.5 percent of the trees, an average of 11 T/A (½ were regeneration). Mortality due to spruce budworm claimed 12.6 percent (33 T/A) 2/3 of which were regeneration. Volume of mortality averaged 32 CF/A or 1.4 percent. Group I stands averaged 84 T/A of timber and 208 T/A regeneration. Group II had 143 T/A timber and 115 T/A regeneration. As stated before, Group II contained all stands with a B.A. over 110 even though the defoliation value may have been quite low (Tables 3 and 4).

Salmon National Forest

The infestation, on the North Fork District of the Salmon National Forest, was first detected in 1977 by aerial observers as light defoliation. Stands sampled during the 1979 field season (Fig. 1), had less than 1 percent top kill and no detected mortality due to spruce budworm. However, the severity of the defoliation is increasing with over 70 percent of the trees moderately to heavily defoliated at the time of the study (Tables 5 and 6). These stands were relatively open grown with an average B.A. of 90 representing 230 T/A of which only 85 were timber.

Targhee National Forest

Stands sampled on the Targhee National Forest were broken into two areas: north of Spencer on the Dubois District and north and east of Kilgore on the Dubois and Island Park Districts (Fig. 2). Defoliation in the Spencer area became apparent in 1975 when light defoliation was first detected. Currently, this area is experiencing heavy defoliation and the trees are affected much more severely than in the Kilgore area where defoliation was not detected until 1978.

In the Spencer area the majority of the trees showed heavy defoliation with under one percent showing light or no defoliation. Top kill was present in 4.3 percent of all Douglas-fir (15 T/A), 5 of which were regeneration. Mortality due to spruce budworm claimed 22 percent of the trees or 65 T/A, 45 of which were regeneration (Tables 7 and 8). Volume of mortality averaged 63.8 CF/A or 3 percent of the total.

In the Kilgore area the basal area averaged 130, but only scattered light defoliation has been apparent for the last two years. Most of the trees sampled were lightly to moderately defoliated with less than one percent of the trees showing heavy defoliation. No top kill or mortality was detected in this area (Tables 9 and 10).

Bridger-Teton National Forest

On the Bridger-Teton National Forest sample stands were scattered over the southern portion of the Teton Division (Fig. 3). Parts of this Division have experienced defoliation since 1965. Other parts of this Division had defoliation detected first in 1974. Although some stands fell in Analysis Unit 4, the amount of tree injury and mortality was lower than stands on the Targhee National Forest.

Stands with a basal area over 110 or a defoliation value over 12 did show signs of top kill (Tables 11 and 12). But, at this time, no mortality was detected on any stands sampled. Top kill was detected on 5.8 percent of the Douglas-fir, (15 T/A). In this grouping, few trees were in the green or light defoliation categories (18.8%). Most trees showed moderate defoliation (55%).

Stands with a basal area less than 110 and defoliation values of 12 or less had about the same amount of defoliation. Most Douglas-fir (55%) again fell in the moderate defoliation category; however, no top kill or mortality was detected in these stands (Tables 13 and 14).

Other host species such as subalpine fir and spruce on the Bridger-Teton experienced some injury from spruce budworm defoliation (Tables 15 and 16). Top kill occurred on 1 T/A (2%) of the spruce and 41 T/A (14.2%) of the subalpine fir, 32 T/A were regeneration. No mortality was detected.

Growth Reduction

Growth reduction is shown in Table 17 and is computed on trees with detected top kill. Although other effects may occur from defoliation such as growth slowdown and bole deformities, they cannot be accurately calculated at this time.

The Salmon National Forest showed less than one CF/A/yr. growth reduction for Douglas-fir in sampled stands; a reduction of less than one percent. Stands on the Targhee National Forest, near Spencer, showed less than one percent growth reduction (0.4 CF/A/yr.) but, an average of 63.7 CF/A has been lost following defoliation caused by spruce budworm. Stands sampled in the Kilgore area have shown no top kill or mortality at the time of this study.

how many years?

Stands on the Bridger-Teton National Forest with high defoliation values and/or high basal area had a reduction of about 1.5% (0.4 CF/A/yr.). Those stands with basal area less than 110 and defoliation values less than 12 have no detected top kill or mortality at this time. The Bridger-Teton National Forest had the only stands with host species other than Douglas-fir recorded. As a result, the "all species" loss was greater than for stands with only Douglas-fir. Both subalpine fir and spruce had observed top kill which resulted in additional growth loss, .5 CF/A/yr. and .1 CF/A/yr. respectively. Stands sampled on the Bridger-Teton had no detected mortality attributed to spruce budworm defoliation.

DISCUSSION

In an attempt to analyze data and organize stands into groups, many methods of comparison have been made, usually involving analysis units. Often some stands would meet the criteria, but would show considerably more or less damage than other stands in the same group. With all the variables to be considered, it has been difficult to determine which factors were most important in analyzing stands.

This year stands were compared by basal area and intensity of defoliation over time. Stands with a basal area under 110 showed little top kill and/or mortality until defoliation values exceeded 12 (Analysis Unit 4). On the other hand, stands with a basal area over 110 showed top kill with a defoliation value as low as 7 (Analysis Unit 3). Since this was the first year permanent plots have been established for budworm on these Forests, the amount of data is still relatively low. However, indications

are that basal area and other factors such as aspect and/or elevation help determine which stands are more susceptible to feeding by spruce budworm.

The current outbreak on the North Fork District of the Salmon National Forest is still relatively new and little growth reduction has been detected. However, defoliation was severe and results from the egg mass survey predict heavy defoliation for 1980. Should this trend continue, top kill and mortality may become more common in the next few years. Stands of a high basal area could be particularly susceptible to injury and death.

The Spencer area on the Targhee National Forest was affected considerably by budworm defoliation. Sampled stands had an amount of mortality which appeared slightly high compared to recorded top kill. Some mortality may have been incorrectly identified, but high mortality, particularly of smaller trees may have occurred in stands of high basal area occupying drier sites. If this is the case, stands near Kilgore could realize similar effects if defoliation continues in that area.

The infestation on the Bridger-Teton National Forest has continued in some areas for several years. However, injury and mortality have not yet reached high levels. In 1977, a similar survey was made and at that time 58 percent of the Douglas-fir experienced top kill in the stands visited. The 1979 survey sampled from different stands and found 5.8 percent of the Douglas-fir, 14.3 percent of the subalpine fir and 1.8 percent of the spruce with some degree of top kill. Data taken in 1979 may be more precise because of refined sampling techniques, but direct comparisons are not possible due to different sample areas. Whatever the exact degree of top kill present as defoliation continues, additional trees will suffer from top kill and mortality.

Stands sampled this year were permanently marked and with additional plots in other stands which will be established in the next few years, a better understanding of the effects of budworm defoliation will be realized. The knowledge of effects will change somewhat as additional data are collected, but the information now on hand should be indicative as to general conditions and trends. By revisiting these stands at later dates, the real effects of defoliation by budworm can be quantified.

APPENDIX

Explanation of Tables

Each table represents a comaprison of several different stands with similar characteristics. Comparisons are made by tree species and unit of measure (i.e. T/A or CF/A). Arrays represent averages for these stands and percents of the total, within that comparison.

The first row of each matrix represents trees with a DBH less than 5". Row two and three are trees 5" to 11.9" and 12" or greater, respectively.

Headings refer to:

Green	- Undefoliated trees.
Light D.	- Trees with light current defoliation.
Moderate D.	- Trees with moderate to heavy current and visible past defoliation.
Heavy D.	- Heavy current and conspicious past defoliation.
Light TK.	- Less than 10% top kill.
Moderate TK.	- 10% - 33% top kill.
Heavy TK.	- Over 33% top kill.
Mortality	- Trees killed by spruce budworm defoliation.

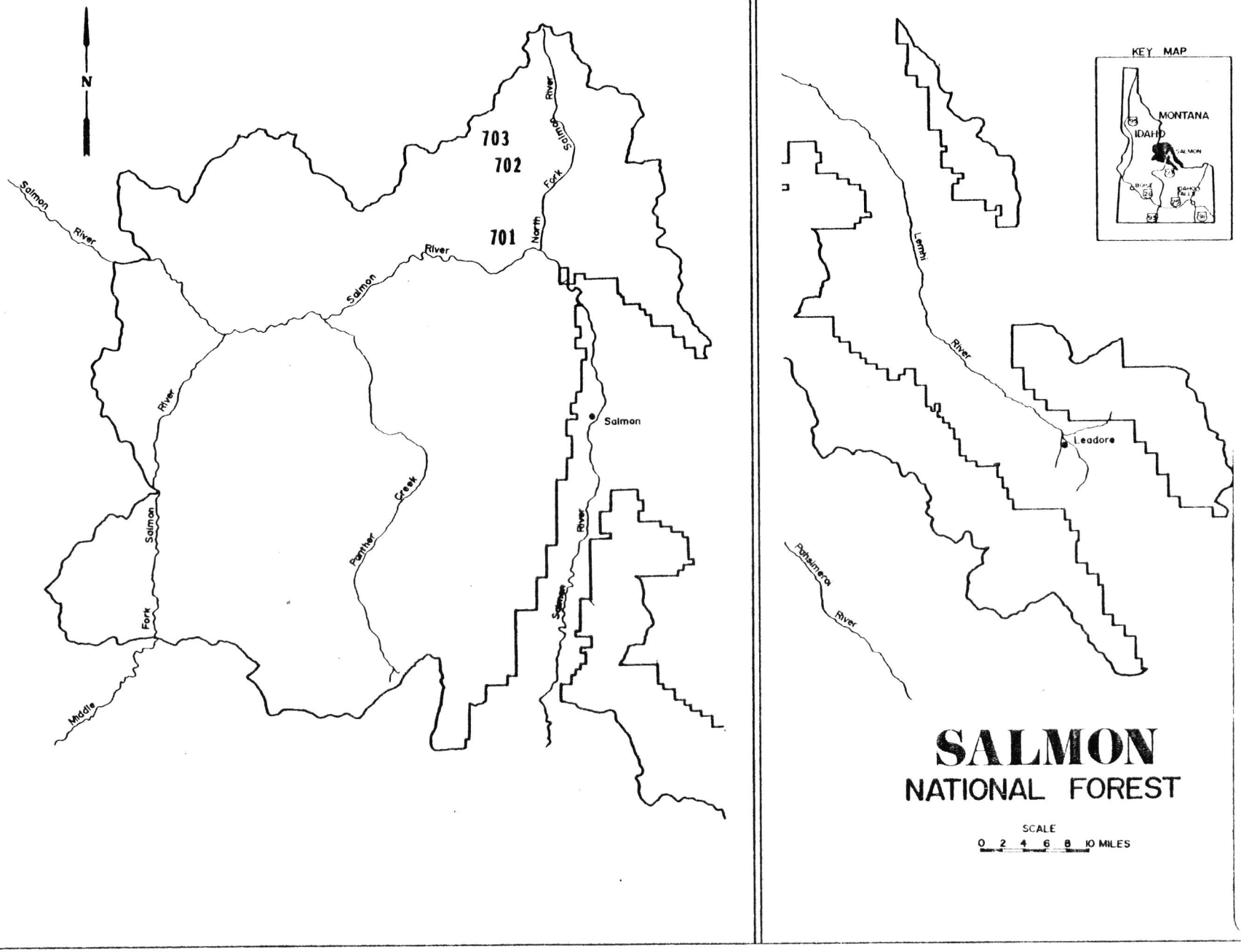
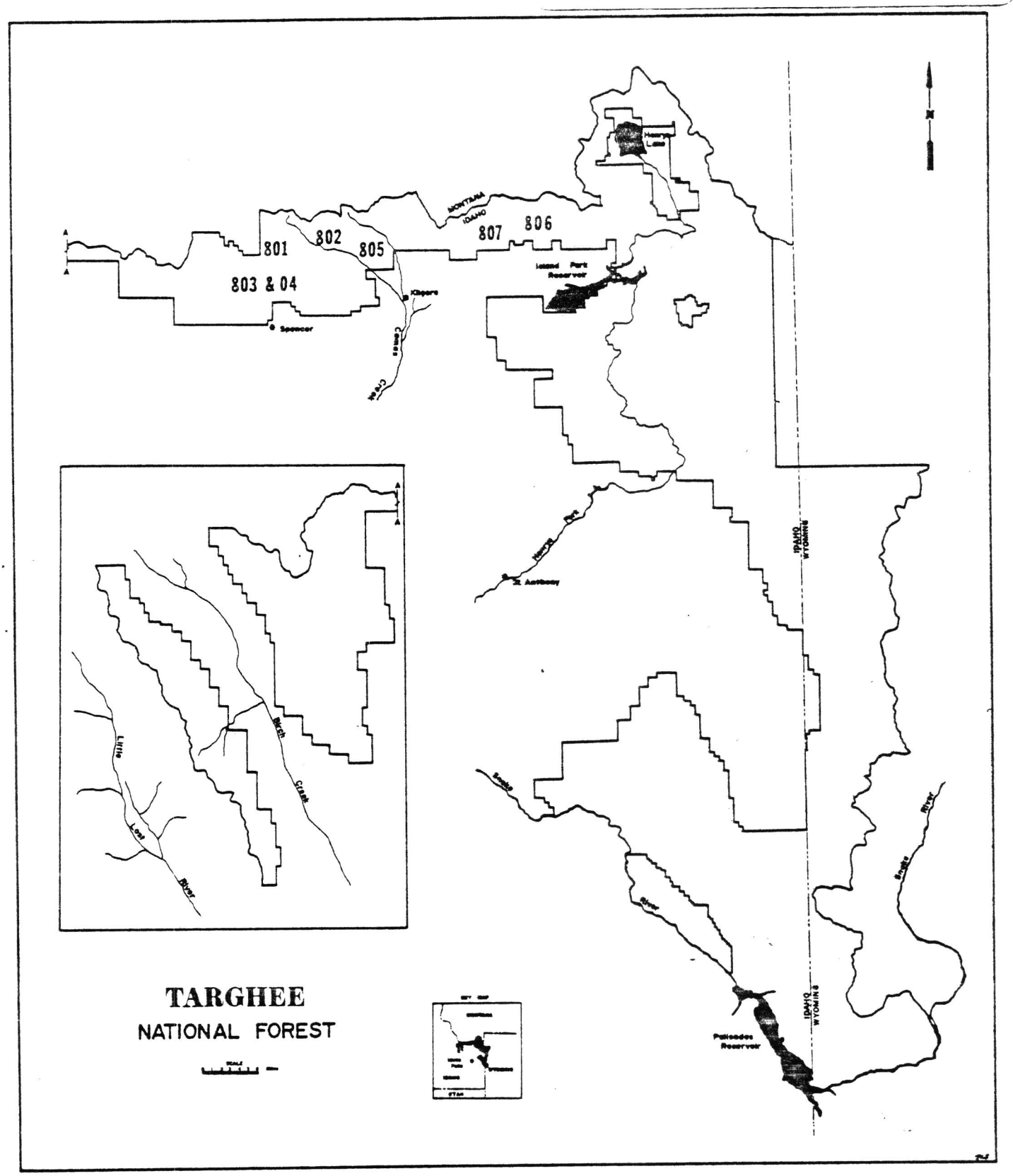

N
703
702
701
Salmon River
Salmon River
North Fork Salmon River
Salmon River
Salmon
Panther Creek
Salmon River
Middle Fork Salmon River
Salmon River
KEY MAP
MONTANA
IDAHO
SALMON
Lemhi River
Leadore
Pahsimera River
SALMON
NATIONAL FOREST
SCALE
0 2 4 6 8 10 MILES

FIGURE 1

FIGURE 2


801
802
805
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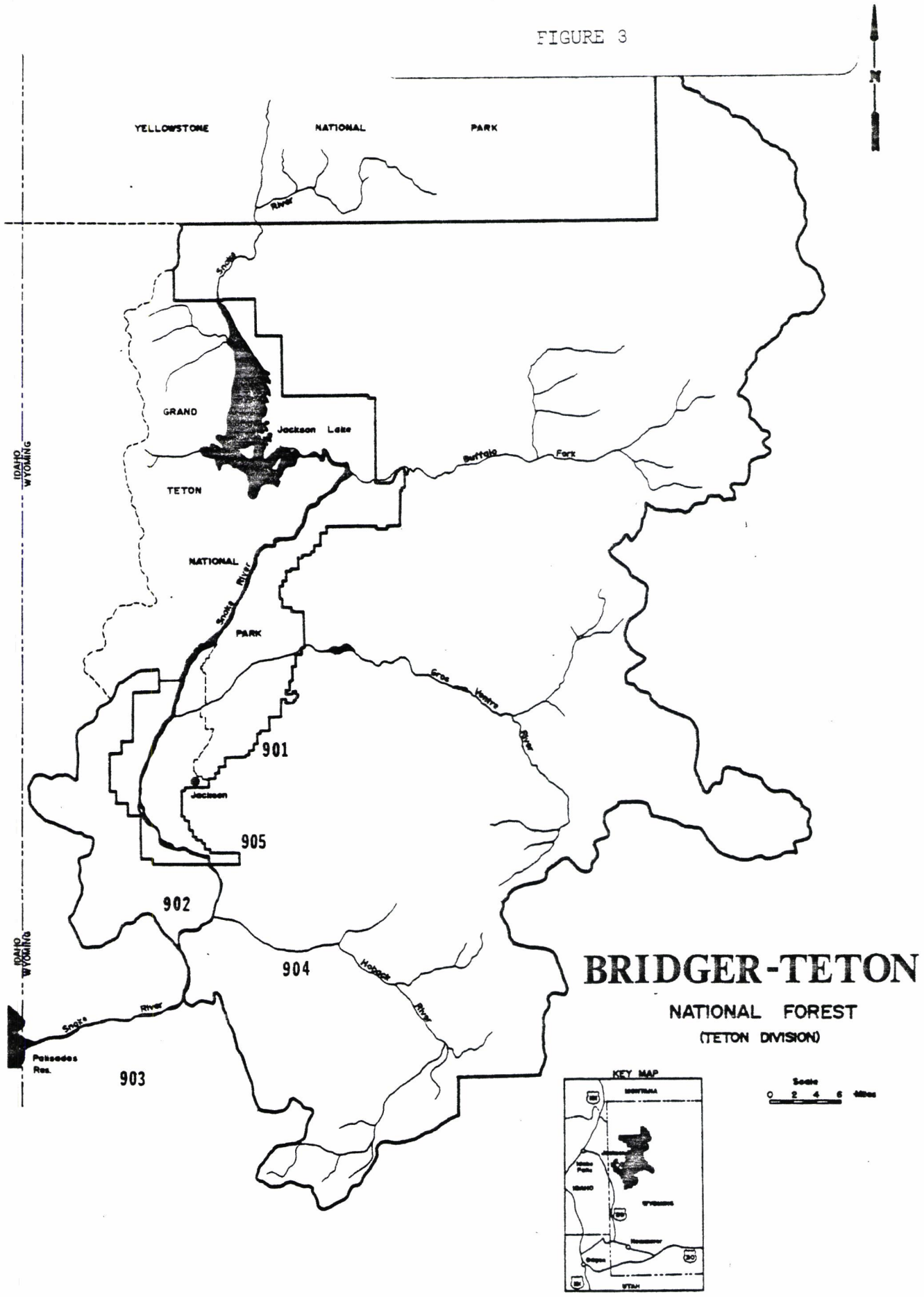
807
806
MONTANA
IDAHO
Spencer
Island Park Reservoir
Henrys Fork
St. Anthony
IDAHO
WYOMING
Little Lost River
Big Creek
Snake River
Palisades Reservoir
TARGHEE
NATIONAL FOREST

FIGURE 3


YELLOWSTONE
NATIONAL
PARK
River
Snake
GRAND
Jackson Lake
TETON
NATIONAL
PARK
IDAHO
WYOMING
Buffalo
Fork
Snake River
Gros Ventre
River
901
Jackson
905
902
904
903
Hoback
River
Snake
River
Palisades
Res.
BRIDGER-TETON
NATIONAL FOREST
(TETON DIVISION)
KEY MAP
Scale
0 2 4 6 Miles

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DOUGLAS FIR

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1979 S.B.W. IMPACT ** ALL FORESTS ** STANDS(110 BA AND DEF.(12 (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
46.946	56.331	61.623	42.717	0.000	0.000	0.000	0.000
1.789	6.147	32.010	21.189	0.000	0.000	0.000	0.000
.637	3.009	11.594	7.457	.160	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
16.099	19.317	21.132	14.649	0.000	0.000	0.000	0.000
.613	2.108	10.977	7.266	0.000	0.000	0.000	0.000
.218	1.032	3.976	2.557	.055	0.000	0.000	0.000

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DOUGLAS FIR

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1979 S.B.W. IMPACT ** ALL FORESTS ** STANDS)110 BA OR DEF.)12 (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
3.849	20.724	46.818	15.625	6.094	0.000	0.000	22.500
.889	17.311	42.055	26.464	1.798	3.193	0.000	10.153
1.420	5.046	20.526	14.391	.716	0.000	0.000	.108

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
1.482	7.981	18.029	6.017	2.347	0.000	0.000	8.665
.342	6.666	16.195	10.191	.692	1.229	0.000	3.910
.547	1.943	7.905	5.542	.276	0.000	0.000	.041

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DOUGLAS FIR

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1979 IMPACT DATA *** SALMON NATIONAL FOREST *** (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
31.763	15.883	55.293	41.177	0.000	0.000	0.000	0.000
2.247	10.657	24.437	23.487	0.000	0.000	0.000	0.000
0.000	0.000	11.560	12.170	.373	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
13.868	6.935	24.141	17.977	0.000	0.000	0.000	0.000
.981	4.653	10.669	10.254	0.000	0.000	0.000	0.000
0.000	0.000	5.047	5.313	.163	0.000	0.000	0.000

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DOUGLAS FIR

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1979 S.B.W. IMPACT *** TARGHEE NATIONAL FOREST *** SPENCER AREA (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
0.000	0.000	54.393	52.205	4.688	0.000	0.000	45.000
0.000	0.000	22.480	47.943	1.850	5.140	0.000	20.305
.053	1.220	11.218	29.878	.930	0.000	0.000	.215

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
0.000	0.000	18.282	17.547	1.576	0.000	0.000	15.125
0.000	0.000	7.556	16.114	.622	1.728	0.000	6.825
.018	.410	3.770	10.042	.313	0.000	0.000	.072

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DOUGLAS FIR

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1979 S.B.W. IMPACT *** TARGHEE NATIONAL FOREST *** KILGORE AREA (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
71.667	138.333	88.333	0.000	0.000	0.000	0.000	0.000
1.927	26.227	12.077	0.000	0.000	0.000	0.000	0.000
3.773	13.233	24.540	1.380	0.000	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
18.786	36.261	23.155	0.000	0.000	0.000	0.000	0.000
.505	6.875	3.166	0.000	0.000	0.000	0.000	0.000
.989	3.469	6.433	.362	0.000	0.000	0.000	0.000

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DOUGLAS FIR

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1979 S.B.W. IMPACT **BRIDGER TETON N.F.** STANDS)110 BA OR DEF)12 (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
5.263	10.263	30.263	25.000	10.000	0.000	0.000	0.000
2.370	23.623	89.203	22.630	2.327	1.660	0.000	0.000
1.430	4.830	21.170	1.837	.670	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
2.084	4.064	11.984	9.899	3.960	0.000	0.000	0.000
.938	9.354	35.322	8.961	.921	.657	0.000	0.000
.566	1.913	8.383	.727	.265	0.000	0.000	0.000

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DOUGLAS FIR

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1979 S.B.W. IMPACT **BRIDGER TETON N.F.** STANDS(110 BA AND DEF(=12 (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
16.665	33.335	33.330	8.335	0.000	0.000	0.000	0.000
0.000	0.000	46.720	14.955	0.000	0.000	0.000	0.000
0.000	1.180	14.345	.830	0.000	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
9.821	19.644	19.641	4.912	0.000	0.000	0.000	0.000
0.000	0.000	27.532	8.813	0.000	0.000	0.000	0.000
0.000	.695	8.453	.489	0.000	0.000	0.000	0.000

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SUB ALPINE FIR

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1979 S.B.W. IMPACT *** BRIDGER TETON N.F. *** ALL STANDS (TREES/ACRE)

AVERAGE ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
27.063	42.655	112.610	28.530	12.500	19.780	0.000	0.000
1.105	2.683	17.745	10.453	8.863	0.000	0.000	0.000
0.000	0.000	4.253	.495	0.000	0.000	0.000	0.000

PERCENT ARRAY

GREEN	LIGHT D.	MODER. D.	HEAVY D.	LIGHT TK	MODER. TK	HEAVY TK	MORTALITY
9.373	14.773	39.001	9.881	4.329	6.851	0.000	0.000
.383	.929	6.146	3.620	3.069	0.000	0.000	0.000
0.000	0.000	1.473	.171	0.000	0.000	0.000	0.000

Table 17.

GROWTH LOSS

	Stand #	Name	Douglas-Fir % of Normal	Douglas-Fir Growth Loss CF/A	All Species % of Normal	All Species Growth Loss CF/A
Salmon NF	701	Donnelly Gulch	100.0	0.0	100.0	0.0
	702	W. Fork Hughes Cr.	97.8	0.81	98.3	0.81
	703	Allen Cr.	100.0	0.0	100.0	0.0
		Average	99.3	0.27	99.4	0.27
Targhee NF	801	Sheep Creek	98.7	0.84	98.7	0.84
	802	Porcupine Pass	100.0	0.0	100.0	0.0
	803	Picnic Hollow	98.3	0.79	98.3	0.79
	804	Beaver Cr.	100.0	0.0	100.0	0.0
	805	Bear Gulch	100.0	0.0	100.0	0.0
	806	Taylor Cr.	100.0	0.0	99.3	0.37
	807	W. Sheraton Cr.	100.0	0.0	100.0	0.0
		Average	99.6	0.23	99.5	0.29
Bridger-Teton NF	901	Curtis Campground	99.1	0.44	99.1	0.44
	902	Prichard Pass	100.0	0.0	98.3	0.65
	903	Squaw Cr.	96.5	0.79	95.6	1.53
	904	Fall Cr.	100.0	0.0	96.3	1.60
	905	Game Cr.	100.0	0.0	100.0	0.0
		Average	99.1	0.25	97.9	0.84

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